

## WHAT IS CLAIMED:

1. An improved system for thermal treatment of a selected target within a subject, the system comprising:

(a) an RF energy source capable of producing an output RF power signal directed to an applicator contactable with a surface of a biological tissue belonging to the subject, said applicator capable of delivering a desired amount of energy to a predetermined energy dissipation zone beneath said surface of said biological tissue, the selected target positioned within said predetermined energy dissipation zone;

(b) a phase shifter, said phase shifter capable of shifting a phase of directed traveling waves of said output signal so that energy therefrom is concentrated primarily in said predetermined energy dissipation zone, which lies at a desired depth beneath said surface of said biological tissue;

(c) an impedance matching network (IMN), said IMN capable of converting the impedance of said biological tissue belonging to the subject from a nominal value to a corrected value, said corrected value matching an impedance characteristic of said RF energy source and said phase shifter so that said output traveling wave may pass through said surface of said biological tissue without being converted to a standing wave;

(d) an RF resonator located in said applicator, said RF resonator capable of cyclically accumulating and releasing said desired amount of energy, said RF resonator further capable of concentrating said desired amount of energy so that a significant portion thereof is concentrated in said predetermined energy dissipation zone; and

(e) said applicator capable of conveying said output RF power signal from said RF energy source through said surface of said biological tissue to said predetermined energy dissipation zone after said output has been processed by said phase shifter, said IMN and said resonator;

wherein operation of the system produces a reverse thermal gradient so that said surface of said biological tissue is maintained at a lower temperature than said predetermined energy dissipation zone without a cooling device; and

wherein the absence of a ground electrode permits free propagation of said waves of said output RF power signal in said energy dissipation zone.

2. The system of claim 1, further comprising a pulse width modulation *controller*, said pulse width modulation controller capable of causing said RF energy source to deliver said output signal in pulses of a predetermined duration and amplitude with a desired frequency.

3. The system of claim 1, further comprising a dielectric barrier positionable between said applicator and said surface of said biological tissue; said dielectric barrier preventing transmission of a conductive current.

4. The system of claim 1, wherein said applicator is made from at least one metal selected from the group consisting of aluminum, silver, gold, copper and alloys thereof.

5. The system of claim 3, wherein said dielectric barrier is supplied as a dielectric coating on said applicator.

6. The system of claim 5, wherein said applicator is constructed primarily of aluminum and said dielectric barrier is supplied as an alumina coating.

7. The system of claim 1, wherein said applicator is movable on said surface of said biological tissue as a means of altering a location of said energy dissipation zone.

8. The system of claim 1, further comprising a feeding cable, said feeding cable connecting said RF- applicator and said RF-resonator with said IMN.

9. The system of claim 8, wherein said feeding cable has a resonance length defined by  $n \cdot \lambda / 2$  length, where  $\lambda$  is a wavelength of RF-energy in the cable material and  $n$  is a whole number.

10. The system of claim 1, wherein said IMN includes a fixed structure characterized by a shape selected from the group consisting of L shaped, T shaped and  $\Pi$ -shaped structure.

11. The system of claim 1, wherein said IMN includes a broadband impedance transformer.

12. The system of claim 1, wherein said IMN is variable.

13. The system of claim 1, wherein said phase shifter includes a trombone type.

14. The system of claim 1, wherein said phase shifter is at least partially constructed of coaxial cable.

15. The system of claim 1, wherein a phase shift provided by said phase shifter is variable.

16. The system of claim 1, wherein coupled energy is delivered from RF-generator (amplifier).

17. The system of claim 1, wherein said energy delivered to said predetermined energy dissipation zone is coupled in continuous or pulsing mode.

18. The system of claim 1, wherein said RF-energy is characterized by a resonance frequency which matches a known natural resonance frequency of the selected target.

19. The system of claim 1, further comprising at least one additional component selected from the group consisting of a laser beam, an ultrasonic transducer, a UV light source, a plasma treatment device and a flash lamp.

20. An improved method for thermal treatment of a selected target within a subject, the method comprising:

(a) providing an output RF power signal directed to an applicator contactable with a surface of a biological tissue belonging to the subject,

(b) employing a phase shifter to shift a phase of traveling waves in said output RF power signal so that energy therefrom is concentrated primarily in a predetermined energy dissipation zone which lies at a desired depth beneath said surface of said biological tissue, wherein the selected target is positioned within said predetermined energy dissipation zone;

(c) converting the impedance of said biological tissue belonging to the subject from a nominal value to a corrected value, said corrected value matching an impedance characteristic of said RF-source and phase shifter so that said output signal may pass through said surface of said biological tissue without being converted to a standing wave by means of an impedance matching network (IMN);

(d) cyclically accumulating in an RF resonator located in said applicator, and releasing therefrom, said desired amount of energy,

(e) concentrating said desired amount of energy in said RF resonator so that a significant portion thereof is concentrated in said predetermined energy dissipation zone upon release therefrom; and

(f) conveying said output signal of RF energy through said surface of said biological tissue to said predetermined energy dissipation zone after said output has been processed by said phase shifter, said IMN and said resonator by means of said applicator;

wherein performance of (a)–(f) produce a reverse thermal gradient so that said surface of said biological tissue is maintained at a lower temperature than said predetermined energy dissipation zone, thereby obviating the need for a cooling device; and

wherein the absence of a ground electrode permits free propagation of said waves in said output signal in said energy dissipation zone.

21. The method of claim 20, wherein said providing indicates provision of said output signal in pulses of a predetermined duration and amplitude with a desired frequency

22. The method of claim 20, further comprising interposing a dielectric barrier between said applicator and said surface of said biological tissue; said dielectric barrier preventing transmission of a conductive current.

23. The method of claim 20, further comprising constructing said applicator from at least one metal selected from the group consisting of aluminum, silver, gold, copper and alloys thereof.

24. The method of claim 22, wherein said dielectric barrier is supplied as a dielectric coating on said applicator.

25. The method of claim 24, further comprising constructing said applicator primarily of aluminum and said dielectric barrier is supplied as an alumina coating

26. The method of claim 20, further comprising moving said applicator with respect to said surface of said biological tissue as a means of altering a location of said energy dissipation zone.

27. The method of claim 20, further comprising employing a feeding cable to connect said RF- applicator and said RF-resonator with said IMN.

28. The method of claim 27, wherein said feeding cable has a resonance length defined by  $n \cdot \lambda / 2$  length, where  $\lambda$  is a wavelength of RF-energy in the cable material and  $n$  is whole number

29. The method of claim 20, wherein said IMN includes a fixed structure characterized by a shape selected from the group consisting of L shaped, T shaped and  $\pi$  shaped structure.

30. The method of claim 20, wherein said IMN includes a broadband impedance transformer.

31. The method of claim 20, wherein said IMN is variable.

32. The method of claim 20, wherein said phase shifter includes a trombone type.

33. The method of claim 20, wherein said phase shifter is at least partially constructed of coaxial cable.

34. The method of claim 20, wherein a phase shift provided by said phase shifter is not constant.

35. The method of claim 20, said providing an output signal of RF energy indicates coupled energy.

36. The method of claim 20, wherein said energy delivered to said predetermined energy dissipation zone is coupled in continuous or pulsing mode.

37. The method of claim 20, wherein said desired amount of energy released by said RF resonator is characterized by a resonance frequency that matches a known resonance frequency of the selected target.

38. The method of claim 20, further comprising at least one additional component selected from the group consisting of a laser beam, an ultrasonic transducer, a UV light source, a plasma treatment device and a flash lamp.

39. The method of claim 20, wherein (a) through (f) are performed in the order listed.

40. An improved method for cellulite treatment, the method comprising:

- (a) providing an output signal of RF energy directable to an applicator contactable with a surface of a biological tissue belonging to the subject,
- (b) employing a phase shifter to shift a phase of waves in said output traveling wave so that energy therefrom is concentrated primarily in a predetermined energy dissipation zone which lies at a desired depth beneath said surface of said biological tissue, wherein the selected target is positioned within said predetermined energy dissipation zone, said predetermined energy dissipation zone including at least one cellulite body;
- (c) converting the impedance of said biological tissue belonging to the subject from a nominal value to a corrected value, said corrected value matching an impedance characteristic of said RF-power source and said phase shifter so that said output signal

may pass through said surface of said biological tissue without being converted to a standing wave by means of an impedance matching network (IMN);

(d) cyclically accumulating in an RF resonator located in said applicator, and releasing therefrom, said desired amount of energy,

(e) concentrating said desired amount of energy in said RF resonator so that a significant portion thereof is concentrated in said predetermined energy dissipation zone upon release therefrom; and

(f) conveying said output from said RF energy source through said surface of said biological tissue to said predetermined energy dissipation zone after said output has been processed by said phase shifter, said IMN and said resonator by means of said applicator;

wherein performance of (a)–(f) produce a reverse thermal gradient so that said surface of said biological tissue is maintained at a lower temperature than said predetermined energy dissipation zone, thereby obviating the need for a cooling device; and

wherein the absence of a ground electrode permits free propagation of said waves in said output signal in said energy dissipation zone; and

wherein said at least one cellulite body is heated to a greater degree than a tissue adjacent thereto.